DRAFT − CUPS Software Programmers Manual

CUPS−SPM−1.0b1

Easy Software Products
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Preface

This software programmers manual provides software programming information for the Common UNIX Printing System ("CUPS") Version 1.0.

System Overview

The Common UNIX Printing System provides a portable printing layer for UNIX® operating systems. It has been developed by Easy Software Products to promote a standard printing solution for all UNIX vendors and users. CUPS provides the System V and Berkeley command−line interfaces.

CUPS uses the Internet Printing Protocol (IETF−IPP) as the basis for managing print jobs and queues. The Line Printer Daemon (LPD, RFC1179), Server Message Block (SMB), and AppSocket protocols are also supported with reduced functionality.

CUPS adds network printer browsing and PostScript Printer Description ("PPD")−based printing options to support real world applications under UNIX.

CUPS also includes a customized version of GNU GhostScript (currently based off GNU GhostScript 4.03) and an image file RIP that can be used to support non−PostScript printers.

Document Overview

This software administrators manual is organized into the following sections:

- 1 − Printing System Overview
- 2 − The CUPS API
- 3 − Writing Filters
- 4 − Writing Printer Drivers
- 5 − Writing Backends
- A − Constants
- B − Structures
- C − Functions

1 – Printing System Overview

This chapter provides an overview of how the Common UNIX Printing System works.

The Printing Problem

For years *the printing problem* has plagued UNIX®. Unlike Microsoft® Windows® or MacOS, UNIX has no standard interface or system in place for supporting printers. Among the solutions previously available, the Berkeley and System V printing systems are the most prevalent.

These printing systems support line printers (text only) or PostScript printers (text and graphics), and with some coaxing they can be made to support a full range of printers and file formats. However, because each varient of the UNIX operating system uses a different printing system than the next, developing printer drivers for a wide range of printers is extremely difficult. That combined with the limited volume of customers for each UNIX varient has forced most printer vendors to give up supporting UNIX entirely.

The Common UNIX Printing System, or CUPS, is designed to eliminate *the printing problem*. One common printing system can be used by all UNIX varients to support the printing needs of users. Printer vendors can use its modular filter interface to develop a single driver program that supports a wide range of file formats with little or no effort. Since CUPS provides both the System V and Berkeley printing commands, users (and applications) can reap the benefits of this new technology with no changes.

The Technology

CUPS is based upon an emerging Internet standard called the Internet Printing Protocol, or IPP. IPP has been embraced by dozens of printer and printer server manufacturers, and will be supported by the next Microsoft Windows operating system.

IPP defines a standard protocol for printing as well as managing print jobs and printer options like media size, resolution, and so forth. Like all IP−based protocols, IPP can be used locally or over the Internet to printers hundreds or thousands of miles away. Unlike other protocols, however, IPP also supports access control, authentication, and encryption, making it a much more secure printing solution than older ones.

IPP is layered on top of the Hyper−Text Transport Protocol, or HTTP, which is the basis of web servers on the Internet. This allows the user to view documentation and status information on a printer or server using their web browser.

CUPS provides a complete IPP/1.0−based printing system that provides Basic authentication and domain or IP−based access control. Digest authentication and TLS encryption will be available in future versions of CUPS.

Jobs

Each file that is submitted for printing is called a *job*. Jobs are identified by a unique number starting at 1 and are assigned to a particular destination (usually a printer). Jobs can also have options associated with them such as media size, number of copies, and priority.

Classes

CUPS supports collections of printers known as *classes*. Jobs sent to a class are forwarded to the first available printer in the class.

Filters

Filters allow a user or application to print many types of files without extra effort. Print jobs sent to a CUPS server are filtered before sending them to a printer. Some filters convert job files to different formats that the printer can understand. Others perform page selection and ordering tasks. *Backend* filters perform the most important task of all − they send the filtered print data to the printer.

CUPS provides filters for printing many types of image files, HP−GL/2 files, PDF files, and text files. CUPS also supplies PostScript and image file Raster Image Processors, or RIPs, that convert PostScript or image files into bitmaps that can be sent to a raster printer.

CUPS provides backends for printing over parallel and serial ports, and over the network via the JetDirect (AppSocket), Server Message Block, and Line Printer Daemon protocols.

Printer Drivers

Printer drivers in CUPS consist of one of more filters specific to a printer. CUPS includes a sample printer driver for Hewlett−Packard LaserJet and DeskJet printers. While this driver does not generate optimal output for different printer models, it does demonstrate how you can write your own printer drivers and incorporate them into CUPS.

Networking

Printers and classes on the local system are automatically shared with other systems on the network. This allows you to setup one system to print to a printer and use this system as a printer server or spool host for all of the others. If there is only one occurrence of a printer on a network, then that printer can be accessed using its name alone. If more than one printer exists with the same name, users must select the printer by specifying which server to use (e.g. "printer@host1" or "printer@host2".)

CUPS also provides *implicit classes*, which are collections of printers and/or classes with the same name. This allows you to setup multiple servers pointing to the same physical network printer, for example, so that you aren't relying on a single system for printing. Because this also works with printer classes, you can setup multiple servers and printers and never worry about a "single point of failure" unless all of the printers and servers goes down!

2 – The CUPS API

This chapter describes the CUPS Application Programmers Interface ("API").

The CUPS Library

Detecting the CUPS Library in Autoconf

Basic Services

Include Files

Getting the Available Printers and Classes

Printing Files

Setting Printer Options

Cancelling Jobs

HTTP Services

Include Files

Connecting to a Server

Setting Request Fields

Issuing a Request

Getting the Request Status

Sending Request Data

Reading Request Data

IPP Services

Include Files

Creating an IPP Request

Adding Attributes

Sending an IPP Request

Reading an IPP Response

Finding Attributes

Looping Through Attributes

IPP Standard Operations

IPP Extension Operations

CUPS Extension Operations

Language Services

Include Files

Getting the Default Language

Getting the Language Encoding

Getting a Language String

MIME Services

Include Files

Loading a MIME Database

Finding a Specific MIME Type

Finding the MIME Type of a File

Filters

PPD Services

Include Files

Loading a PPD File

Options and Groups

Finding an Option

Finding a Page Size

Marking Options

Checking for Conflicts

Sending Options

3 – Writing Filters

This chapter describes how to write a file filter for CUPS.

Overview

Security Considerations

Users and Groups

Temporary Files

Page Accounting

Command−Line Arguments

Copy Generation

Environment Variables

Writing a HTML Filter

4 – Writing Printer Drivers

This chapter discusses how to write a printer driver, which is a special filter program that converts CUPS raster data into the appropriate commands and data required for a printer.

Overview

Page Accounting

Color Management

Raster Functions

cupsRasterOpen()

cupsRasterReadHeader()

cupsRasterReadPixels()

cupsRasterClose()

Writing a HP−PCL Driver

5 – Writing Backends

This chapter describes how to write a backend for CUPS. Backends communicate directly with printers and allow printer drivers and filters to send data using any type of connection transparently.

Overview

Security Considerations

Users and Groups

Temporary Files

Page Accounting

Retries

Command−Line Arguments

Copy Generation

Environment Variables

Writing a Serial Port Backend

A − Constants

This appendix lists all of the constants that are defined by the CUPS API.

CUPS Constants

HTTP Constants

IPP Constants

Language Constants

MIME Constants

PPD Constants

Raster Constants

B − Structures

This appendix describes all of the structures that are defined by the CUPS API.

C – Functions

This appendix provides a reference for all of the CUPS API functions.

cupsAddOption()

Usage

```
int
cupsAddOption(const char *name,
              const char *value,
              int num_options,
              cups_option_t **options);
```

Arguments

Argument	Description
name	The name of the option.
value	The value of the option.
num_options	Number of options currently in the array.
options	Pointer to the options array.

Returns

The new number of options.

Description

`cupsAddOption()` adds an option to the specified array.

Example

```
#include <cups.h>

...

/* Declare the options array */
int           num_options;
cups_option_t *options;

/* Initialize the options array */
num_options = 0;
options     = (cups_option_t *)0;

/* Add options using cupsAddOption() */
num_options = cupsAddOption("media", "letter", num_options, &options);
num_options = cupsAddOption("resolution", "300dpi", num_options, &options);
```

See Also

cupsFreeOptions(), cupsGetOption(), cupsParseOptions()

cupsCancelJob()

Usage

```
int
cupsCancelJob(const char *dest,
              int job);
```

Arguments

Argument	Description
dest	Printer or class name
job	Job ID

Returns

1 on success, 0 on failure. On failure the error can be found by calling `cupsLastError()`.

Description

`cupsCancelJob()` cancels the specifies job.

Examples

```
#include <cups.h>

cupsCancelJob("LaserJet", 1);
```

See Also

`cupsGetClasses()`, `cupsGetPrinters()`, `cupsLastError()`, `cupsPrintFile()`

cupsDoFileRequest()

Usage

```
ipp_t *
cupsDoFileRequest(http_t *http,
                  ipp_t *request,
                  const char *resource,
                  const char *filename);
```

Arguments

Argument	Description
http	HTTP connection to server.
request	IPP request data.
resource	HTTP resource name for POST.
filename	File to send with POST request (NULL pointer if none.)

Returns

IPP response data or NULL if the request fails. On failure the error can be found by calling cupsLastError().

Description

cupsDoFileRequest() does a HTTP POST request and provides the IPP request and optionally the contents of a file to the IPP server. It also handles resubmitting the request and performing password authentication as needed.

Examples

```
#include <cups.h>

http_t      *http;
cups_lang_t *language;
ipp_t       *request;
ipp_t       *response;

...

/* Get the default language */
language = cupsLangDefault();

/* Create a new IPP request */
request  = ippNew();
```

```
request->request.op.operation_id = IPP_PRINT_FILE;
request->request.op.request_id   = 1;

/* Add required attributes */
ippAddString(request, IPP_TAG_OPERATION, IPP_TAG_CHARSET,
             "attributes-charset", NULL, cupsLangEncoding(language));

ippAddString(request, IPP_TAG_OPERATION, IPP_TAG_LANGUAGE,
             "attributes-natural-language", NULL,
             language != NULL ? language->language : "C");

ippAddString(request, IPP_TAG_OPERATION, IPP_TAG_URI, "printer-uri",
             NULL, "ipp://hostname/resource");

ippAddString(request, IPP_TAG_OPERATION, IPP_TAG_NAME, "requesting-user-name",
             NULL, cupsUser());

/* Do the request... */
response = cupsDoFileRequest(http, request, "/resource", "filename.txt");
```

See Also

cupsLangDefault(), cupsLangEncoding(), cupsUser(), httpConnect(), ippAddString(), ippNew()

cupsDoRequest()

Usage

```
ipp_t *
cupsDoRequest(http_t *http,
              ipp_t *request,
              const char *resource);
```

Arguments

Argument	Description
http	HTTP connection to server.
request	IPP request data.
resource	HTTP resource name for POST.

Returns

IPP response data or `NULL` if the request fails. On failure the error can be found by calling `cupsLastError()`.

Description

`cupsDoRequest()` does a HTTP POST request and provides the IPP request to the IPP server. It also handles resubmitting the request and performing password authentication as needed.

Examples

```
#include <cups.h>

http_t      *http;
cups_lang_t *language;
ipp_t       *request;
ipp_t       *response;

...

/* Get the default language */
language = cupsLangDefault();

/* Create a new IPP request */
request  = ippNew();

request->request.op.operation_id = IPP_GET_PRINTER_ATTRIBUTES;
request->request.op.request_id   = 1;

/* Add required attributes */
```

```
ippAddString(request, IPP_TAG_OPERATION, IPP_TAG_CHARSET,
             "attributes-charset", NULL, cupsLangEncoding(language));

ippAddString(request, IPP_TAG_OPERATION, IPP_TAG_LANGUAGE,
             "attributes-natural-language", NULL,
             language != NULL ? language->language : "C");

ippAddString(request, IPP_TAG_OPERATION, IPP_TAG_URI, "printer-uri",
             NULL, "ipp://hostname/resource");

/* Do the request... */
response = cupsDoRequest(http, request, "/resource");
```

See Also

cupsLangDefault(), cupsLangEncoding(), cupsUser(), httpConnect(), ippAddString(), ippNew()

cupsFreeOptions()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

cupsGetClasses()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

cupsGetDefault()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

cupsGetOption()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

cupsGetPassword()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

cupsGetPPD()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

cupsGetPrinters()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

cupsLangDefault()

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cupsLangEncoding()

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cupsLangFlush()

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cupsRasterOpen()

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cupsRasterReadHeader()

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See Also

cupsRasterReadPixels()

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Argument	Description

Returns

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Examples

See Also

cupsRasterWriteHeader()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

cupsRasterWritePixels()

Usage

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Examples

See Also

cupsServer()

Usage

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See Also

cupsTempFile()

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Examples

See Also

httpDecode64()

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Examples

See Also

httpDelete()

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Argument	Description

Returns

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Examples

See Also

httpEncode64()

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See Also

httpError()

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Returns

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Examples

See Also

httpFlush()

Usage

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Argument	Description

Returns

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Examples

See Also

httpGet()

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See Also

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See Also

httpGetDateTime()

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Examples

See Also

httpGetLength()

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Returns

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httpInitialize()

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Examples

See Also

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Examples

See Also

httpPrintf()

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Arguments

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Returns

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Examples

See Also

httpPut()

Usage

Arguments

Argument	Description

Returns

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Examples

See Also

httpRead()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

httpReconnect()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

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Arguments

Argument	Description

Returns

Description

Examples

See Also

httpSetField()

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Returns

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Argument	Description

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Examples

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Argument	Description

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httpWrite()

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Argument	Description

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Description

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ippAddBoolean()

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Description

Examples

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ippAddBooleans()

Usage

Arguments

Argument	Description

Returns

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Examples

See Also

ippAddDate()

Usage

Arguments

Argument	Description

Returns

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Examples

See Also

ippAddInteger()

Usage

Arguments

Argument	Description

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Examples

See Also

ippAddIntegers()

Usage

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Argument	Description

Returns

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Examples

See Also

ippAddRange()

Usage

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Examples

See Also

ippAddRanges()

Usage

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Examples

See Also

ippAddResolution()

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Examples

See Also

ippAddResolutions()

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Examples

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ippAddSeparator()

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ippRead()

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ippTimeToDate()

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ippWrite()

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Argument	Description

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Examples

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Argument	Description

Returns

Description

Examples

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Argument	Description

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Examples

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Usage

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Argument	Description

Returns

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Examples

See Also

mimeNew()

Usage

Arguments

Argument	Description

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Examples

See Also

mimeType()

Usage

Arguments

Argument	Description

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Examples

See Also

ppdClose()

Usage

Arguments

Argument	Description

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Examples

See Also

ppdConflicts()

Usage

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Argument	Description

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See Also

pddEmitFd()

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See Also

ppdEmit()

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ppdFindChoice()

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See Also

ppdFindMarkedChoice()

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Examples

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ppdFindOption()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

ppdIsMarked()

Usage

Arguments

Argument	Description

Returns

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Examples

See Also

ppdMarkDefaults()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

ppdMarkOption()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

ppdOpenFd()

Usage

Arguments

Argument	Description

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Description

Examples

See Also

ppdOpenFile()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

ppdOpen()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

ppdPageLength()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

ppdPageSize()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also

ppdPageWidth()

Usage

Arguments

Argument	Description

Returns

Description

Examples

See Also